Get Ready for ADS-B

Photo courtesy of Cessna

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Those of us who fly within the United States enjoy what is arguably the safest and most accessible airspace system in the world. It's also one of the most congested. The FAA's answer to this conundrum is the Next Generation Air Transportation System, or "NextGen," modernization initiative.

A critical component of NextGen is a surveillance technology called Automatic Dependent Surveillance-Broadcast (ADS-B). Introduced more than a decade ago, ADS-B enhances air traffic controllers' ability to identify and guide aircraft. It can also provide coverage in areas where radar is not possible, like the Gulf of Mexico or remote regions of Alaska.

Pilots can also benefit from enhanced traffic and weather information that ADS-B technology brings to the cockpit. ADS-B traffic and weather services are already available in Louisville, Kentucky; South Florida; the Gulf of Mexico; Philadelphia; and Juneau, Alaska. By 2013, we'll have ADS-B coverage across the nation everywhere there is radar coverage today.

Why ADS-B?

ADS-B is more timely and accurate when compared with conventional surveillance radar systems, which are limited by line-of-sight geometry problems created by mountains and other large obstacles. GPS is used for the ADS-B position source for aircraft today, which is why there is an increase in the accuracy of information that is being provided to controllers and pilots.

ADS-B enables properly equipped aircraft to broadcast their identification, position, altitude, and velocity to other aircraft and to ATC. This is known as ADS-B *Out*. The receipt by an aircraft or vehicle of ADS-B data is known as ADS-B *In* (a cockpit display is required to receive this data). By 2020, all aircraft operating within designated ADS-B airspace will be required to comply with the equipment performance requirements of ADS-B Out, which will be defined in Title 14 of the Code of Federal Regulations (14 CFR) section 91.225. As of this article's writing, the final rule was expected to appear in the *Federal Register* on April 30, 2010, however, the review requirement could take this timetable into May.

For more information on ADS-B, visit the FAA's NextGen Web site at www.faa.gov/about/initiatives/nextgen/.

All aircraft operating within Class A, B, and C airspace, and some portions of Class E airspace—essentially everywhere you need a transponder today—will be required to meet the prescribed performance standards for positional integrity and other criteria associated with ADS-B avionics.

Meanwhile, two new Advisory Circulars (AC) are being developed to provide guidance on ADS-B equipment certification and installation, as well as provide information on the operational approvals needed to comply with the rule. The ADS-B Technical Standard Order (TSO) for avionics manufacturers is already in place.

Equipment Choices

In the United States, ADS-B-equipped aircraft and vehicles exchange information on one of two frequencies: 1090 or 978 MHz. The 1090 MHz link is already used by Mode A/C and S transponders and Traffic Collision and Avoidance System (TCAS) equipment. ADS-B extends the message elements of Mode S with additional information about the aircraft and its position. This is known as the *extended squitter* and is referred to as 1090ES. Universal Access Transceiver (UAT) equipment operates on 978 MHz.

In the late 1990s, FAA and EUROCONTROL formed an international technical advisory committee to develop standards for ADS-B. The committee issued its final report in 2001, identifying 1090ES as the ADS-B link to be supported by the international aviation community moving forward, with 1090ES being the preferred link for higher-altitude operations. The 978Mhz/UAT link is a U.S. regional link mainly used for Flight Information System-Broadcast (FIS-B) services.

In terms of enabling ATC to identify and track your aircraft, an ADS-B transceiver operating on either link does essentially everything a standard transponder does, plus a lot more. While a Mode C transponder provides ATC with your position (as detected by radar) and pressure altitude, an ADS-B transceiver also emits other data about your flight, including your aircraft's type, velocity, and "geometric altitude," which is used to develop a more accurate indication of position.

The requirements of 14 CFR section 91.215 will remain because aircraft that are required to use TCAS rely on the interrogation function of your transponder for their TCAS to work. (They can only see you if your transponder is squawking a code.) So, while all aircraft flying in ADS-B airspace will continue to need a transponder and an ADS-B Out, modifications or upgrades may be available for certain existing transponders to make them compliant with the new ADS-B Out requirements, possibly eliminating the need for a separate ADS-B Out device. Check with your avionics shop for more details.

ADS-B information is available to any aircraft equipped to receive it, so aircraft on like frequencies can "see" each other on compatible cockpit displays.

Weather uplink Flight Information Service - Broadcast (FIS-B) shows an Alaskan thunderstorm

However, some translation is required to allow the two links to operate simultaneously. ADS-B ground-based radio stations process the messages received on each frequency and send them back out again on the opposite frequency. This process is known as ADS-Rebroadcast (ADS-R) and it is how 1090ES and UAT users can identify one another on traffic displays.

Because commercial airliners and some larger business jets and turboprops are required to have Mode S and TCAS installed, the FAA expects these aircraft will choose to equip with the 1090ES link for ADS-B. Although some general aviation aircraft already have digital transponders that can be upgraded to 1090ES, other general aviation aircraft, typically smaller piston airplanes and light twins that are not required to have TCAS, may choose to equip with UAT avionics.

Operators should consider the impact of the new airspace requirements on their operations before equipping with ADS-B avionics. Your avionics shop can provide you with options tailored to your individual operational and economic needs, so make sure to include them in the decision process.

The Ins and Outs of ADS-B

There are three ways that ADS-B In-equipped aircraft can receive traffic information:

- Directly from other aircraft that are using the same link and are flying within receiving range
- From other ADS-B-equipped aircraft on the opposite link via ADS-R
- Via Traffic Information Services-Broadcast (TIS-B)

TIS-B is the service provided when ADS-B ground-radio stations broadcast traffic information obtained from ATC radar. Pilots flying aircraft that are equipped to receive and display this data (ADS-B In) get a more complete traffic picture in situations when not all aircraft are equipped with ADS-B. On a cockpit display, radar targets will be depicted differently from ADS-B aircraft. Pilots must also remember that TIS-B is not designed or intended to be a collision avoidance system like TCAS. TIS-B traffic data serves only to enhance situational awareness and to aid in the visual spotting of other aircraft.

The other ADS-B In service is called Flight Information System-Broadcast. The FIS-B data stream is packed with information from the National Weather Service, including NEXRAD radar, winds aloft, pilot reports, and many others. FIS-B also includes information on temporary flight restrictions (TFR) and special use airspace (SUA).

Reality Check

Given all the safety benefits that ADS-B will offer to pilots and controllers, it is also important for users to understand what ADS-B is *not*. It is not yet a replacement for your transponder or ground-based radar. While some radar sites are indeed slated for decommissioning, all primary radar and 50 percent

of the secondary radars will remain functional as a backup in the event of a GPS outage.

Complying with the rule is not a one-size-fits-all solution—the answer for each individual depends on what you fly, how you fly, where you fly, and what your budget is, among other factors.

The traffic information offered by TIS-B does not relieve pilots of the responsibility to see and avoid other aircraft. FIS-B information does not relieve pilots of the responsibility to obtain an official preflight briefing or to gain complete information for the intended flight.

The enhanced ATC surveillance services offered by ADS-B Out most likely will not allow instrument approach minima at smaller airports to be lowered, as these minima are more dependent on obstacle and terrain clearance than on surveillance coverage. However, ADS-B may give controllers additional flexibility when clearing aircraft for instrument approaches at non-towered airports, because they may be able to identify outbound IFR aircraft at lower altitudes, possibly all the way to the ground.

Although there is no subscription fee to receive the ADS-B In services, operators and aircraft owners will need the appropriate equipment to display the data, such as a multifunction display or a moving-map GPS receiver.

Operators must meet prescribed performance requirements in order to operate in ADS-B-designated airspace. Any position source that meets the prescribed ADS-B performance standards is acceptable. Today, GPS or WAAS are examples of position sources that meet the performance requirements of ADS-B Out. But, as history has shown with consumer electronics, such as cell phones and microwave ovens, enterprising individuals will continue to build new, better capabilities with each passing year. We can only guess as to what new technologies and avionics will be available to meet the ADS-B performance requirements by the 2020 mandate.

Moving Forward

The FAA recognizes that aircraft owners and operators have concerns about equipping too early. There are significant costs involved and lingering uncertainty among operators about whether today's technology will be viable 10 years from now. The FAA is working hard to ensure that manufacturers bring suitable equipment to the marketplace when it's needed, and that any required upgrades are available at a reasonable cost.

Meanwhile, ADS-B services are expanding as deployment of the ground infrastructure marches forward. By 2013, ADS-B will be available across the NAS everywhere there is radar coverage today. Even though it may seem like a long time until you'll be required to have ADS-B Out to fly in airspace that will be designated by the rule, it's not too early to start understanding the technology and thinking about how you can benefit from its capabilities.

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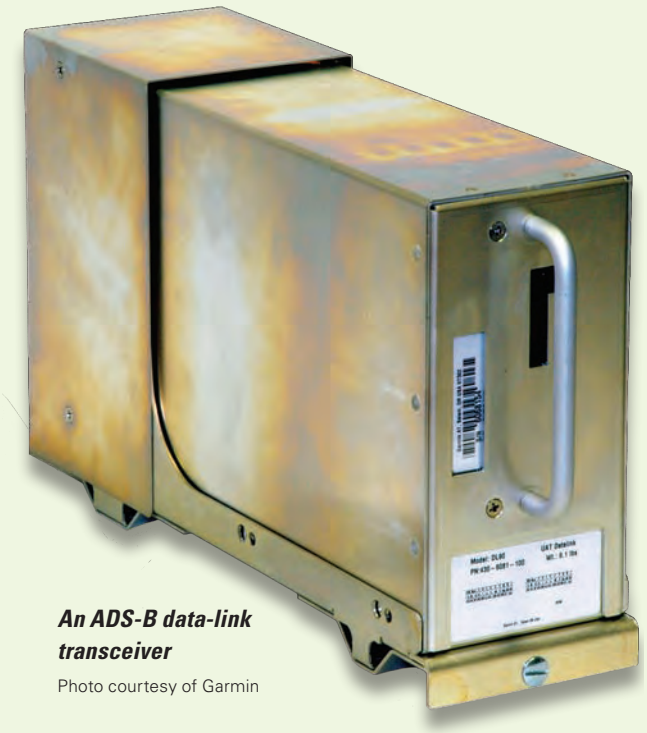

An ADS-B data-link transceiver

Photo courtesy of Garmin